OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **PAWTUCKAWAY LAKE, NOTTINGHAM,** the program coordinators have made the following observations and recommendations:

Thank you for your continued hard work sampling the lake/pond this season! Your monitoring group sampled **five** times this season and has done so for many years! As you know, with multiple sampling events each season, we will be able to more accurately detect changes in water quality. Keep up the good work!

We would like to encourage your monitoring group to formally participate in the DES Weed Watchers program, a volunteer program dedicated to monitoring the lakes and ponds for the presence of exotic aquatic plants. This program only involves a small amount of time during the summer months. Volunteers survey their waterbody once a month from **June** through **September**. To survey, volunteers slowly boat, or even snorkel, around the perimeter of the waterbody and any islands it may contain. Using the materials provided in the Weed Watchers Kit, volunteers look for any species that are of suspicion. After a trip or two around the waterbody, volunteers will have a good knowledge of its plant community and will immediately notice even the most subtle changes. If a suspicious plant is found, the volunteers will send a specimen to DES for identification. If the plant specimen is an exotic, a biologist will visit the site to determine the extent of the problem and to formulate a plan of action to control the nuisance infestation. Remember that early detection is the key to controlling the spread of exotic plants.

If you would like to help protect your lake or pond from exotic plants, contact Amy Smagula, Exotic Species Program Coordinator, at 271-2248 or visit the Weed Watchers web page at www.des.state.nh.us/wmb/exoticspecies/survey.htm.

FIGURE INTERPRETATION

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the lake/pond has been monitored through the program.

  Chlorophyll-a, a pigment found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration measured in the water gives an estimation of the algal concentration or lake productivity. **The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 mg/m^3.**

  NORTH STATION

  The current year data (the top graph) show that the chlorophyll-a concentration ***remained relatively stable*** from **May** to **June,** ***increased*** from **June** to **July**, and then ***decreased*** from **July** to **August**. The chlorophyll-a concentration in **May, June** and **August** was ***less than*** the state mean, and in **July** was ***slightly greater than*** the state mean. (It should be noted that the chlorophyll-a sample for the **North** station was rejected by the lab on the **September** sampling event. The sample rejection was due to a labeling error.)

  The historical data (the bottom graph) show that the 2004 chlorophyll-a mean is ***less than*** the state mean.

  Overall, visual inspection of the historical data trend line (the bottom graph) shows an ***increasing*** in-lake chlorophyll-a trend since monitoring began. Specifically the mean concentration has ***worsened*** since ***1988***.

  SOUTH STATION

  The current year data (the top graph) show that the chlorophyll-a concentration ***decreased*** from **May** to **June**, ***increased*** from **June** to **July**, and then ***decreased*** from **July** to **August**. The chlorophyll-a concentration in **May, June** and **August** was ***less than*** the state mean, and in **July** was ***slightly greater than*** the state mean. (It should be noted that the chlorophyll-a sample for the **South** station was rejected by the lab on the **September** sampling event. The sample rejection was due to a labeling error.)

The historical data (the bottom graph) show that the 2004 chlorophyll-a mean is ***slightly less than*** the state mean.

Overall, visual inspection of the historical data trend line (the bottom graph) a ***variable*** in-lake chlorophyll-a trend since monitoring began. Specifically the mean concentration has ***fluctuated between approximately 3 and 10 mg/m³*** since ***1992***.

In the 2005 annual report, since your group will have sampled the chlorophyll-a concentration at the North and South deep spot for at least 10 consecutive years, we will conduct a statistical analysis of the historic data to determine if there has been a significant change in the annual mean since monitoring began.

While algae are naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes/ponds, phosphorus is the nutrient that algae depend upon for growth. Algal concentrations may increase with an increase in nonpoint sources of phosphorus loading from the watershed, or in-lake sources of phosphorus loading (such as phosphorus releases from the sediments). Therefore, it is extremely important for volunteer monitors to continually educate residents about how activities within the watershed can affect phosphorus loading and lake/pond quality.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for lake/pond transparency. Table 3 (Appendix B) lists the maximum, minimum and mean transparency data for each sampling season that the lake/pond has been monitored through the program.

  Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. **The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.**

  NORTH STATION

  The current year data (the top graph) show that the in-lake transparency ***decreased*** from **May** to **June**, ***increased gradually*** from **June** to **August**, and then ***decreased slightly*** from **August** to **September**. The transparency in **May, June** and **July** was ***less than*** the state mean, and in **August** and **September** was ***slightly less than*** the state mean.

The historical data (the bottom graph) show that the 2004 mean transparency is ***less than*** the state mean, and is the shallowest annual mean since monitoring began.

Overall, visual inspection of the historical data trend line (the bottom graph) shows a ***stable*** transparency trend since monitoring began. Specifically, the mean transparency has ***remained between approximately 3 and 4 meters*** since ***1988***.

SOUTH STATION

The current year data (the top graph) show that the in-lake transparency ***decreased*** from **May** to **June**, and then ***increased very gradually*** from **June** to **September**. The transparency on **each sampling event** was ***less than*** the state mean.

Overall, visual inspection of the historical data trend line (the bottom graph) shows a ***stable*** transparency trend since monitoring began. Specifically, the mean transparency has ***remained between approximately 3 and 4 meters*** since ***1992***.

As previously discussed, since your group will have sampled the transparency at the North and South deep spot for at least 10 consecutive years, the 2005 annual report will include a statistical analysis of the historic data to determine if there has been a significant change in the annual mean since monitoring began.

Typically, high intensity rainfall causes erosion of sediments into lakes/ponds and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, lake/pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake/pond. Guides to Best Management Practices designed to reduce, and possibly even eliminate, nonpoint source pollutants, such as sediment loading, are available from DES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the lake/pond has joined the program.

  Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a lake/pond can lead to increases in plant and algal growth over time.

The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 12 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.

NORTH STATION

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration ***remained stable*** from **May** to **July**, ***decreased slightly*** from **July** to **August**, and then ***increased slightly*** from **August** to **September.** The phosphorus concentration in **May, June, July** and **September** was ***approximately equal to*** the state median, and in **August** was ***less than*** the state median.

The historical data show that the 2004 mean epilimnetic phosphorus concentration is ***slightly less than*** the state median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration ***remained stable*** from **May** to **June,** and then ***increased consistently*** from **June** to **September**. The phosphorus concentration in **May** and **June** was ***slightly less than*** the state median, in **July** was ***greater than*** the state median, and in **August** and **September** was ***much greater than*** the state median.

The turbidity and total phosphorus concentration in the hypolimnion (lower layer) sample was ***elevated*** on the **July, August** and **September** events this season. Historically, the turbidity and phosphorus levels have been ***elevated*** in the hypolimnion on most sampling events. This suggests that the lake bottom is composed of a thick layer of organic material that is easily disturbed. The presence of a thick organic layer on the lake bottom (which is likely comprised of decomposed plants and algae, and also sediment) would also explain the lower dissolved oxygen concentration near the lake bottom.

The historical data show that the 2004 mean hypolimnetic phosphorus concentration is ***much greater than*** the state median.

Overall, visual inspection of the historical data trend line for the epilimnion shows ***relatively stable*** phosphorus trend. Specifically, the mean annual concentration has ***remained between approximately 10 and 15 ug/L*** since monitoring began in ***1988***.

Overall, visual inspection of the historical data trend line for the hypolimnion shows an ***increasing*** phosphorus trend since monitoring began. Specifically, the mean annual concentration has ***worsened*** since monitoring began.

As previously discussed, since your group will have sampled the transparency at the deep spot for at least 10 consecutive years, the 2005 annual report will include a statistical analysis of the historic data to determine if there has been a significant change in the annual mean since monitoring began.

SOUTH STATION

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration ***decreased slightly*** from **May** to **June**, ***increased greatly*** from **June** to **July**, ***decreased greatly*** from **July** to **August**, and then ***remained stable*** from **August** to **September**. The phosphorus concentration in **May, August** and **September** was ***approximately equal to*** the state median, in **June** was ***slightly less than*** the state median, and in **July** was ***much greater than*** the state median.

The total phosphorus concentration in the epilimnion (upper layer) sample was ***elevated*** (**41 ug/L**) on the **July** sampling event. This suggests that a rainstorm may have contributed phosphorus-enriched stormwater runoff to the lake just prior to sampling. It is possible that phosphorus entered the lake in this manner and was still concentrated in the epilimnion at the time of sampling.

The historical data show that the 2004 mean epilimnetic phosphorus concentration is ***greater than*** the state median.

The current year data for the hypolimnion (the bottom inset graph) show that the phosphorus concentration ***decreased*** from **May** to **June**, ***increased slightly*** from **June** to **July**, ***increased*** from **July** to **August**, and then ***decreased*** from **August** to **September**. The phosphorus concentration in **May** and **August** was ***greater than*** the state median and in **June, July** and **September** was ***slightly less than*** the state median.

The turbidity and total phosphorus concentration in the hypolimnion (lower layer) sample was ***elevated*** on the **August** sampling event this season (**4.55 NTUs** and **23ug/L**, respectively). Historically, the turbidity and phosphorus levels have been ***elevated*** in the hypolimnion on most sampling events. As discussed previously, this suggests that the lake bottom is composed of a thick layer of organic material that is easily disturbed.

The historical data show that the 2004 mean hypolimnetic phosphorus concentration is ***slightly greater than*** the state median.

Overall, visual inspection of the historical data trend line for the epilimnion shows a ***variable*** phosphorus trend. Specifically, the mean annual concentration has ***fluctuated between approximately 8 and 29 ug/L*** since monitoring began in ***1992***.

Overall, visual inspection of the historical data trend line for the hypolimnion shows a ***variable*** phosphorus trend since monitoring began. Specifically, the mean annual concentration has ***fluctuated between approximately 10 and 60 ug/L*** since monitoring began.

As previously discussed, since your group will have sampled the phosphorus concentration at the North and South deep spot for at least 10 consecutive years, the 2005 annual report will include a statistical analysis of the historic data to determine if there has been a significant change in the annual mean since monitoring began.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands.

TABLE INTERPRETATION

- **Table 2: Phytoplankton**

  Table 2 (Appendix B) lists the current and historical phytoplankton species observed in the lake/pond. Specifically, this table lists the three most dominant phytoplankton species observed in each sample and their relative abundance in each sample. In addition, this table has been enhanced this year to include the overall phytoplankton cell abundance rating of the sample. The overall phytoplankton cell abundance in a sample is calculated using a formula based on the relationship that DES biologists have observed over the years regarding phytoplankton concentrations, algal concentrations, and biological productivity in New Hampshire's lakes and ponds. A mathematical equation is used to classify the overall abundance of phytoplankton cells in a sample into the following categories: *sparse, scattered, moderate, common, abundant,* and *very abundant.* Generally, the more phytoplankton cells there are in a sample, the higher the chlorophyll concentration and the higher the biological productivity of the lake.

Due to measured cyanobacteria blooms in past years, DES and lake association members have embarked upon a more aggressive cyanobacteria watch program. This program will identify periods during the summer season when cyanobacteria may be prevalent and will be used as an early warning system to notify residents when swimming may be hazardous for recreational activities. Plankton samples were collected on each sampling event this season. The plankton species observed this season did not very greatly from month to month, however, for the specific species and relative percent abundance of each sampling event please see Table 2.

NORTH STATION

The dominant phytoplankton species observed this season were ***Asterionella*** **(diatom),** ***Dinobryon*** **(golden-brown algae),** ***Cyclotella*** **(diatom),** ***Tabellaria*** **(diatom),** ***Mallomonas*** **(golden-brown algae),** ***Chrysosphaerella*** **(golden-brown algae),** and ***Rhizosolenia*** **(diatom).**

The overall abundance ratings of phytoplankton cells in the samples this season were calculated to be ***scattered*** in **May, July** and **September**, and ***abundant*** in **June**. (It should be noted that the abundance rating could not be calculated for the **August** sample, as the depth the plankton haul was not reported with the sample.)

SOUTH STATION

The dominant phytoplankton species observed this season were ***Asterionella*** **(diatom),** ***Tabellaria*** **(diatom),** ***Cyclotella*** **(diatom),** ***Dinobryon*** **(golden-brown algae),** ***Chrysosphaerella*** **(golden-brown algae), R*hizosolenia* (diatom),** and ***Staurastrum*** **(green algae).**

The overall abundance ratings of phytoplankton cells in the samples this season were calculated to be ***scattered*** in **May**, ***sparse*** in **July** and **September** and ***common*** in **June**. (It should be noted that the abundance rating could not be calculated for the **August** sample, as the depth the plankton haul was not reported with the sample.)

Phytoplankton populations undergo a natural succession during the growing season (Please refer to the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding seasonal plankton succession). Diatoms and golden-brown algae are typical in New Hampshire's less productive lakes and ponds.

- **Table 2: Cyanobacteria**

  Small amounts of the cyanobacteria ***Anabaena, Microcystis*** *and* ***Oscillatoria*** were observed in most of the plankton samples this season. ***These species, if present in large amounts, can be toxic to livestock, wildlife, pets, and humans.*** (Please refer to the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding cyanobacteria).

  Cyanobacteria can reach nuisance levels when phosphorus loading from the watershed to surface waters is increased (this is often caused by rain events) and favorable environmental conditions occur (such as a period of sunny, warm weather).

  The presence of cyanobacteria serves as a reminder of the lake's/pond's delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading to the lake/pond by eliminating fertilizer use on lawns, keeping the lake/pond shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads.

  In addition, residents should also observe the lake/pond in September and October during the time of fall turnover (lake mixing) to document any algal blooms that may occur. Cyanobacteria have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface and bloom. Wind and currents tend to "pile" cyanobacteria into scums that accumulate in one section of the lake/pond. If a fall bloom occurs, please collect a sample (any clean jar or bottle will be suitable) and contact the VLAP Coordinator.

- **Table 4: pH**

  Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

  pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 6.0 limits the growth and reproduction of fish. A pH between 6.0 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is **6.6**, which indicates that the surface waters in the state are slightly acidic. For a more detailed explanation regarding pH, please refer to the "Chemical Monitoring Parameters" section of this report.

NORTH STATION

The mean pH at this deep spot this season ranged from **5.96** in the hypolimnion to **6.42** in the epilimnion, which means that the water is ***slightly acidic.***

SOUTH STATION

The mean pH at the deep spot this season ranged from **6.09** in the hypolimnion to **6.43** in the epilimnion, which means that the water is ***slightly acidic.***

It is important to point out that the pH in the hypolimnion (lower layer) was ***lower (more acidic)*** than in the epilimnion (upper layer). This increase in acidity near the lake bottom is likely due the decomposition of organic matter and the release of acidic by-products into the water column.

Due to the presence of granite bedrock in the state and acid deposition (from snowmelt, rainfall, and atmospheric particulates) in New Hampshire, there is not much that can be done to effectively increase lake/pond pH.

- **Table 5: Acid Neutralizing Capacity**
  Table 5 (Appendix B) presents the current year and historical epilimnetic ANC for each year the lake/pond has been monitored through VLAP.

  Buffering capacity (ANC) describes the ability of a solution to resist changes in pH by neutralizing the acidic input. The mean ANC value for New Hampshire's lakes and ponds is **6.6 mg/L**, which indicates that many lakes and ponds in the state are at least "moderately vulnerable" to acidic inputs. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

  The mean Acid Neutralizing Capacity (ANC) of the epilimnion (the upper layer) was **3.1 mg/L** this season at the **North Station**, and was **3.7 mg/L** at the **South Station,** both of which are ***less than*** the state mean. In addition, this indicates that the lake/pond is ***moderately vulnerable*** to acidic inputs (such as acid precipitation).

- **Table 6: Conductivity**
  Table 6 (Appendix B) presents the current and historical conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current (which is determined by the number of negatively charged ions from metals, salts, and minerals in the water column). The mean conductivity value for New Hampshire's lakes and ponds is **59.4 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

  The mean annual conductivity in the epilimnion at the **North Station** deep spot this season was **47.9 uMhos/cm**, and at the **South Station** deep spot this season was **48.1 uMhos/cm,** both of which are ***slightly less than*** the state mean.

  The conductivity in the lake/pond is relatively ***stable*** and ***relatively low*** (with the exception of **Fernalds A** and **White Grove Brook**).

  The conductivity continued to remain ***much greater than*** the state mean in the **Fernalds A** and **White Grove Brook** inlets this season. Typically, sources of increased conductivity are due to human activity. These activities include septic systems that fail and leak leachate into the groundwater (and eventually into the tributaries and the lake/pond), agricultural runoff, and road runoff (which contains road salt during the spring snow melt). New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could contribute to increasing conductivity. In addition, natural sources, such as iron and manganese deposits in bedrock, can influence conductivity.

  We recommend that your monitoring group *continue* to conduct stream surveys and storm event sampling along the inlets with elevated conductivity so that we can *better* determine what may be causing the increases.

  For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report "Special Topic Article" or contact the VLAP Coordinator.

  We also recommend that your monitoring group conduct a shoreline conductivity survey of the lake and the tributaries with ***elevated*** conductivity to help pinpoint the sources of ***elevated*** conductivity.

  To learn how to conduct a shoreline or tributary conductivity survey, please refer to the 2004 "Special Topic Article" in Appendix D of this report.

It is possible that de-icing materials applied to nearby roadways during the winter months may be influencing the conductivity in the lake/pond. In New Hampshire, the most commonly used de-icing material is salt (sodium chloride).

Therefore, we recommend that the **epilimnion** be sampled for chloride next season. We also recommend that your monitoring group sample the major inlets to lake/pond to determine the conductivity and chloride levels of the streamflow to the pond. This sampling may help us pinpoint what areas of the watershed are contribute to the increasing in-lake conductivity.
Please note that there will be an additional cost for each of the chloride samples and that these samples must be analyzed at the DES laboratory in Concord. In addition, it is best to conduct chloride sampling in the spring soon after the snow has melted.

Please read this year's Special Topic Article, "Conductivity is on the rise in New Hampshire's Lakes and Ponds: What is causing the increase and what can be done?" which is found in Appendix D of this report. This article may help your association understand what types of activities can lead to elevated conductivity and chloride levels and what residents can do to minimize this type of pollution.

- **Table 8: Total Phosphorus**
Table 8 (Appendix B) presents the current year and historical total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

The total phosphorus concentrations in the **#08 Fernalds A, #09 Fernalds B, Fernalds Upstream** and **#08F Upstream** continued to be ***very elevated*** (in the **500 – 2000 ug/L** range) this season. The turbidity (Table 11) of the samples collected in this part of the watershed were also ***elevated*** (as much as **12 NTUs**), which suggests that the stream bottom may have been disturbed while sampling or that erosion is occurring in this portion of the watershed.

When the stream bottom is disturbed, sediment that typically contains attached phosphorus is released into the water column. When collecting inlet samples, please be sure to sample where the stream is flowing and where the stream is deep enough to collect a "clean" sample.

If you suspect that erosion is occurring in this portion of the watershed, we recommend that your monitoring group conduct a stream survey and storm event sampling along this inlet. This additional sampling may allow us to determine what is causing the ***elevated*** levels of turbidity and phosphorus.

For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report "Special Topic Article" or contact the VLAP Coordinator.

- **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**
  Table 9 (Appendix B) shows the dissolved oxygen/temperature profile(s) for the 2004 sampling season. Table 10 (Appendix B) shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

  The dissolved oxygen/temperature profile conducted by the VLAP biologist during the **May** annual visit showed ***relatively high*** dissolved oxygen concentrations in the hypolimnionn at both deep spots. However on the **September** sampling event the dissolved oxygen concentration was ***much lower in the hypolimnion (lower layer) than in the epilimnion (upper layer)*** at both deep spots of the lake. During this season, and many past sampling seasons, the lake/pond has had a lower dissolved oxygen concentration and a higher total phosphorus concentration in the hypolimnion (lower layer) than in the epilimnion (upper layer). These data suggest that the process of ***internal phosphorus loading*** is occurring in the lake/pond. When oxygen levels are depleted to less than 1 mg/L in the hypolimnion **(as it was this season and in many past seasons)**, the phosphorus that is normally bound up with metals in the sediment may be re-released into the water column. Since an internal source of phosphorus in the lake/pond may be present, it is even more important that watershed residents act proactively to minimize phosphorus loading from the watershed.

  As previously mentioned, the turbidity and total phosphorus concentration in the hypolimnion (lower layer) sample was ***elevated*** on many of the sampling events this season. Historically, the dissolved oxygen concentration has been ***low*** in the hypolimnion on the **August** sampling events as well. This suggests that the lake bottom is composed of a thick layer of organic material that is easily disturbed.

- **Table 11: Turbidity**
  Table 11 (Appendix B) lists the current year and historical data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the "Other Monitoring Parameters" section of this report for a more detailed explanation.
  The turbidity of the **North Station** hypolimnetic sample on the **July, August** and **September** sampling events was ***elevated*** (**9.82, 40.1, 4.87 NTUs** respectively). The turbidity of the **South Station** hypolimnetic sample on the **August** sampling event was ***elevated*** (**4.55 NTUs**). This suggests that the lake/pond bottom may have been disturbed by the anchor or by the Kemmerer Bottle while sampling and/or that the lake bottom is covered by a thick organic layer of sediment which is easily disturbed. When the lake/pond bottom is disturbed, sediment, which typically contains attached phosphorus, is released into the water column. When collecting the hypolimnion sample, make sure that there is no sediment in the Kemmerer Bottle before filling the sample bottles.

  As discussed previously, the turbidity of the epilimnion (upper layer) sample was ***elevated*** (**11.7 NTUs**) on the **July** sampling event. This suggests that a rainstorm may have recently contributed stormwater runoff to the lake and/or an algal bloom had occurred in the lake.

  As discussed previously, the turbidity in the samples collected from **#08 Fernalds A** and **#08F Upstream** continued to be ***elevated*** this season. The turbidity at **Fernalds Upstream** was also ***elevated*** this season, which suggests that erosion is occurring in this portion of the watershed and/or that there is a large amount of algal cells in the water in these locations.

  If you suspect that erosion is occurring in this portion of the watershed, we recommend that your monitoring group conduct a stream survey and storm event sampling along this inlet. This additional sampling may allow us to determine what is causing the ***elevated*** levels of turbidity.

  For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report "Special Topic Article" or contact the VLAP Coordinator.

- **Table 12: Bacteria (*E.coli*)**
  Table 12 lists only the historical data for bacteria (*E.coli*) testing. (Please note that Table 12 now lists the maximum and minimum results for all past sampling seasons.) *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **MAY** be present. If sewage is present in the water, potentially harmful disease-causing organisms **MAY** also be present.

  It should be noted that bacteria sampling was not conducted this year. If residents are concerned about sources of bacteria such as failing septic systems, animal waste, or waterfowl waste, it is best to conduct *E. coli* testing when the water table is high, when beach use is heavy, or immediately after rain events.

- **Table 14: Current Year Biological and Chemical Raw Data**
  This table is a new addition to the Annual Report. This table lists the most current sampling season results. Since the maximum, minimum, and annual mean values for each parameter are not shown on this table, this table displays the current year "raw" (meaning unprocessed) data. The results are sorted by station, depth zone (epilimnion, metalimnion, and hypolimnion) and parameter.

- **Table 15: Station Table**
  This table is a new addition to the Annual Report. As of the Spring of 2004, all historical and current year VLAP data are included in the DES Environmental Monitoring Database (EMD). To facilitate the transfer of VLAP data into the EMD, a new station identification system had to be developed. While volunteer monitoring groups can still use the sampling station names that they have used in the past (and are most familiar with), an EMD station name also exists for each VLAP sampling location. For each station sampled at your lake or pond, Table 15 identifies what EMD station name corresponds to the station names you have used in the past and will continue to use in the future.

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

During the annual visit to your lake/pond, the biologist conducted a "Sampling Procedures Assessment Audit" for your monitoring group. Specifically, the biologist observed the performance of your monitoring group while sampling and filled out an assessment audit sheet to document the ability of the volunteer monitors to follow the proper field sampling procedures (as outlined in the VLAP Monitor's Field Manual). This assessment is used to identify any aspects of sample collection in which volunteer monitors fail to follow proper procedures, and also provides an opportunity for the biologist to retrain the volunteer monitors as necessary. This will ultimately ensure that the samples that the volunteer monitors collect are truly representative of actual lake and tributary conditions.

Overall, your monitoring group did an ***excellent*** job collecting samples on the annual biologist visit this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the biologist to provide additional training. Keep up the good work!

Sample Receipt Checklist:

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if the volunteer monitors followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, future re-occurrences of improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did a ***very good*** job when collecting samples this season! Specifically, the members of your monitoring group followed the majority of the proper field sampling procedures when collecting and submitting samples to the laboratory. However, the laboratory did identify one aspect of sample collection that the volunteer monitors could improve upon, as follows:

- **Sample labeling:** Please make sure to label your samples with a waterproof pen (a black sharpie permanent marker works best), preferably before sampling. Make sure that the ink does not wash off the bottle when exposed to water. Please make sure to include station name, depth (if applicable), the date and lake/pond name. Chlorophyll-a samples were rejected in September due to improper labeling. If your association has made its own sample bottle labels, please make sure to fold over one corner of each label before placing it on a sample bottle so that the label will not become permanently attached to the bottle. In addition, please make sure that the labels will stick to the bottles when they are wet.

USEFUL RESOURCES

Acid Deposition Impacting New Hampshire's Ecosystems, NHDES Fact Sheet ARD-32, (603) 271-2975 or www.des.state.nh.us/factsheets/ard/ard-32.htm.

Best Management Practices to Control Nonpoint Source Pollution: A Guide for Citizens and Town Officials, NHDES Booklet WD-03-42, (603) 271-2975.

Best Management Practices for Well Drilling Operations, NHDES Fact Sheet WD-WSEB-21-4, (603) 271-2975 or www.des.nh.gov/factsheets/ws/ws-21-4.htm.

Canada Geese Facts and Management Options, NHDES Fact Sheet BB-53, (603) 271-2975 or www.des.state.nh.us/factsheets/bb/bb-53.htm.

Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, NHDES Fact Sheet WMB-10, (603) 271-2975 or www.des.state.nh.us/factsheets/wmb/wmb-10.htm.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, NHDES Fact Sheet WD-SP-1, (603) 271-2975 or www.des.state.nh.us/factsheets/sp/sp-1.htm.

Freshwater Jellyfish In New Hampshire, NHDES Fact Sheet WD-BB-5, (603) 271-2975 or www.des.state.nh.us/factsheets/bb/bb-51/htm.

Impacts of Development Upon Stormwater Runoff, NHDES Fact Sheet WD-WQE-7, (603) 271-2975 or www.des.state.nh.us/factsheets/wqe/wqe-7.htm.

IPM: An Alternative to Pesticides, NHDES Fact Sheet WD-SP-3, (603) 271-2975 or www.des.state.nh.us/factsheets/sp/sp-3.htm.

Iron Bacteria in Surface Water, NHDES Fact Sheet WD-BB-18, (603) 271-2975 or www.des.state.nh.us/factsheets/bb/bb-18.htm.

Lake Foam, NHDES Fact Sheet WD-BB-4, (603) 271-2975 or www.des.state.nh.us/factsheets/bb/bb-5.htm.

Lake Protection Tips: Some Do's and Don'ts for Maintaining Healthy Lakes, NHDES Fact Sheet WD-BB-9, (603) 271-2975 or www.des.state.nh.us/factsheets/bb/bb-9.htm.

Proper Lawn Care In the Protected Shoreland, The Comprehensive Shoreland Protection Act, NHDES Fact Sheet WD-SP-2, (603) 271-2975 or www.des.state.nh.us/factsheets/sp/sp-2.htm.

Road Salt and Water Quality, NHDES Fact Sheet WD-WMB-4, (603) 271-2975 or www.des.state.nh.us/factsheets/wmb/wmb-4.htm.

Sand Dumping - Beach Construction, NHDES Fact Sheet WD-BB-15, (603) 271-2975 or www.des.state.nh.us/factsheets/bb/bb-15.htm.

Shorelands Under the Jurisdiction of the Comprehensive Shoreland Protection Act, NHDES Fact Sheet SP-4, (603) 271-2975 or www.des.state.nh.us/factsheets/sp/sp-4.htm.

Soil Erosion and Sediment Control on Construction Sites, NHDES Fact Sheet WQE-6, (603) 271-2975 or www.des.state.nh.us/factsheets/wqe/wqe-6.htm.

Swimmers Itch, NHDES Fact Sheet WD-BB-2, (603) 271-2975 or www.des.state.nh.us/factsheets/bb/bb-2.htm.

Through the Looking Glass: A Field Guide to Aquatic Plants, North American Lake Management Society, 1988, (608) 233-2836 or www.nalms.org.

Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants, NHDES Fact Sheet WD-BB-4, (603) 271-2975 or www.des.state.nh.us/factsheets/bb/bb-4.htm.